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Summary of Previous Investigations

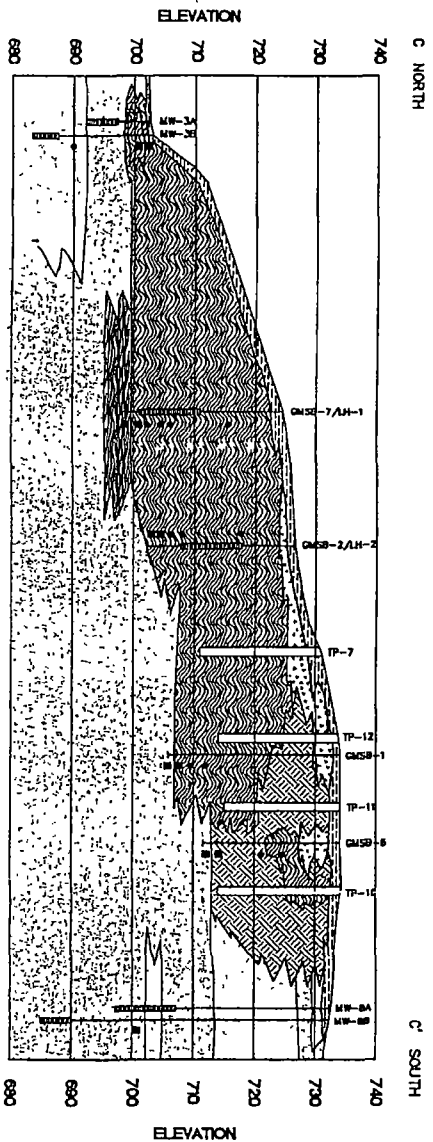
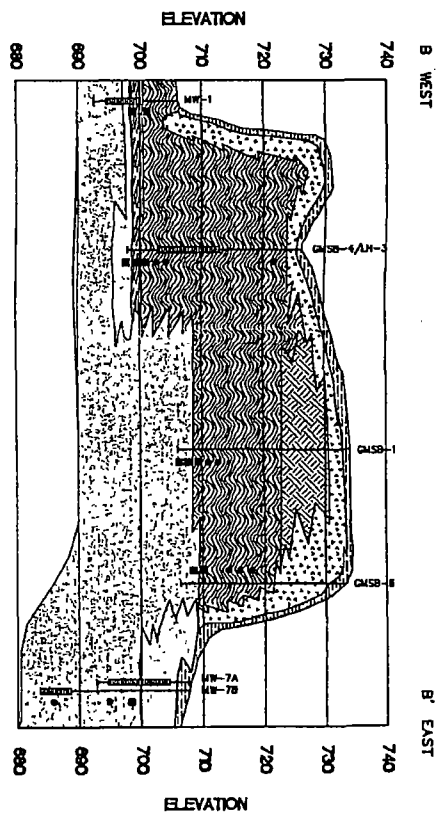
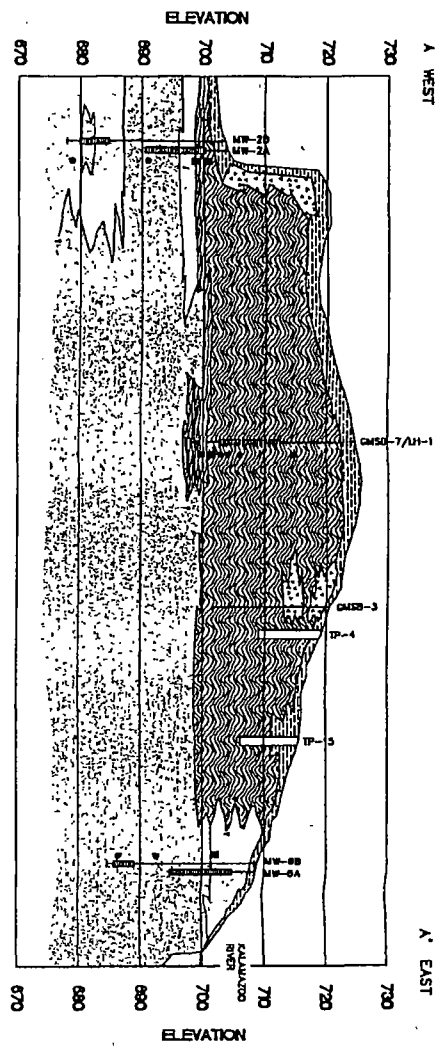
NAME/DATE	OBJECTIVES	SAMPLING PERFORMED	RESULTS/CONCLUSIONS	COMMENTS
June and September 1987 and January 1989. MDNR and Mill Staff, 24 soil and residual samples outside berm (Discussed in G&M, 1994a)	Evaluate extent of PCBs present outside retaining berm	Twenty-four soil and residual samples	PCBs were reported at concentrations ranging from <ul style="list-style-type: none"> <0.1 mg/kg to 39 mg/kg for 23 of 24 samples (east, north and northwest), and 120 mg/kg in one sample (west). 	<ul style="list-style-type: none"> Data may be outdated. Locations of sample collection are uncertain QA/QC procedures are uncertain.
(G&M, 1991) "12 th Street Landfill Geophysical Investigation, Plainwell, Michigan." Letter Report by Geraghty and Miller, Inc. October 11, 1991.	Determine whether buried metal objects are present within landfill.	Electromagnetic conductivity survey and proton precession magnetometer survey, both on 20-foot grid	<ul style="list-style-type: none"> Magnetic and electrical anomalies were detected. Buried metallic objects are likely present in the landfill, mainly in the southern and eastern portions 	
(G&M, 1994a) "Test Pit Investigation, Technical Memorandum, 12 th Street Landfill Operable Unit, Plainwell, Michigan, Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site." Geraghty and Miller, Inc. February 18, 1994	<ul style="list-style-type: none"> Evaluate sources of geophysical anomalies Characterize nature of paper residuals Determine vertical and horizontal extent of regulated constituents in landfill Provide data for risk assessments 	<ul style="list-style-type: none"> Eleven test pits and 5 trenches excavated within the landfill Thirty-one samples analyzed for TCL/TAH (VOCs, semivolatiles, pesticides and PCBs, inorganics) Three samples analyzed for polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) Magnetic survey conducted Preliminary screening procedure done to identify chemicals of interest for further assessment 	<ul style="list-style-type: none"> Paper residuals are of two general types: light gray and dark gray, light-gray on top, and dark-gray deeper Bailing wire and construction debris were found in quantities sufficient to cause geophysical anomalies Empty drums of various types were found in several test pits. One drum was found to contain ignitable hazardous waste. The retaining berm consists of fly ash overlain by sand. Residuals are covered by 1-5 feet of cover. Leachate is perched above the residuals and is retained in construction debris, soil cover, and the retaining berm Acetone, 2-butanone, and BTEX were the most frequently detected VOCs. VOCs generally were found at lower concentrations in samples from deeper locations (dark-gray residuals less VOCs than light-gray residuals). The highest VOC concentration was detected is toluene (29.0 mg/kg, D lab qualifier). SVOCs were detected infrequently Pesticides 4,4'-DDE and 4,4'-DDT, were detected in half of the samples. The greatest diversity and greatest concentration of pesticides are located in the southcentral area of landfill PCBs were detected in concentrations ranging from 0.027 mg/kg (J, P lab qualifiers) to 74 mg/kg (C lab qualifier). Aroclor-1254 was most frequently detected (17 of 29 samples analyzed). Generally, higher concentrations were from dark-gray residuals. Generally low concentrations of inorganics were detected Dioxins and furans were found in each of three residual samples analyzed Preliminary screening suggests the following ranking of chemicals for decreasing significance for site worker exposure: PCBs, pesticides, PCDDs/PCDFs, inorganics, SVOCs, and VOCs. 	Data were gathered from inside landfill footprint only.

Summary of Previous Investigations (continued)

NAME/DATE	OBJECTIVES	SAMPLING PERFORMED	RESULTS/CONCLUSIONS	COMMENTS
(G&M, 1994b). "Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site Remedial Investigation/Feasibility Study, Technical Memorandum 8, 12 th Street Landfill Operable Unit, Plainwell, Michigan " Geraghty and Miller, Inc. May 31, 1994.	<ul style="list-style-type: none"> Characterize chemical nature of wastes Define any identifiable contaminant sources. Determine vertical and horizontal extent of contamination originating from site Spatially quantify contamination to enable preparation of an Endangerment Assessment and an FS. Identify contaminant migration pathways and movement Define distribution of PCBs, and chemically characterize residuals. Determine hydraulic conductivity of aquifer Assess potential groundwater impacts along the periphery of the landfill Assess the potential for leachate to transport chemicals from the landfill Identify local groundwater flow systems, and evaluate the degree of hydraulic connection between the river and the groundwater system Prepare a focused feasibility study 	<ul style="list-style-type: none"> Fourteen hand-auger "delineation" borings (DB-1 through DB-14) around the outside of the perimeter of landfill <ul style="list-style-type: none"> Residuals samples reportedly collected at base of residuals and analyzed for PCBs Soil below residuals reportedly analyzed for TCL/TAL Fifteen soil borings (MW-2A/MW-2B through MW-8A/MW-8B and MW-1) along the circumference of landfill; eight sampled <ul style="list-style-type: none"> Eight borings converted to monitoring wells, seven converted to piezometers; "A" wells shallow Water level measurements taken on August 31, September 3, September 12, September 28, and December 15, 1993 GW and leachate analyzed for TCL, TAL, COD, TSS, TOC, nitrate, chloride, sulfate, alkalinity, and PCBs Seven soil borings (GMSB-1 through GMSB-7) advanced within landfill, six of which go through to underlying materials <ul style="list-style-type: none"> Samples at interface of residuals and underlying soil analyzed for TCL/TAL Three converted to leachate head wells Hydraulic conductivity tests at 10 monitoring well locations Two river gauges installed Desktop and field wetlands assessment 	<ul style="list-style-type: none"> The soil/sand/fly ash cover on the landfill ranges from 2 and 7 feet thick. This is in contrast to the 1- to 7-foot-thick cover, as stated in the RI (G&M, 1996b) The residuals within the landfill are approximately 25 feet thick at the thickest location (near GMSB-4 and GMSB-7) Residuals extend laterally 60 feet beyond the berm on the northern and western sides of the landfill Perched leachate is present within the residuals The upper portion of the aquifer consists of sand and gravel Shallow groundwater is in direct hydraulic connection with the river. The Plainwell dam has a major influence on groundwater flow The distribution of PCBs within the residuals shows lower concentrations from 2 to 18 feet deep (7.2 mg/kg average) and higher concentrations from 18-28 feet deep (42.4 mg/kg average). Concentrations of PCBs ranged from below the detection limit to 158 mg/kg in the residuals. SVOCs (including benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and chrysene) were found in only one surface sample. However, no SVOCs were detected in the sample of residuals collected immediately above this sample. Subsurface soil generally contained PCBs at concentrations one to two orders of magnitude lower than the residuals immediately above them Benzene, 2-methylnaphthalene and alpha-chlordane were detected in one subsurface soil sample, but not in groundwater or leachate samples, suggesting that significant leaching of these chemicals is not occurring PCBs were not detected in any groundwater or leachate samples, suggesting that PCBs are not migrating with leachate in the landfill or with groundwater, either in a dissolved state or by colloidal transport. One SVOC, bis(2-ethylhexyl)phthalate, was found in groundwater samples from MW-3A 	<ul style="list-style-type: none"> "Delineation" series of borings (DB-1 through DB-14) were not logged. The depth to the base of the residuals is unclear Depth of PCB samples from some of the DB- borings was not recorded. Monitoring wells were reportedly installed inside the landfill toe, with the exception of MW-6A, MW-6B, MW-7A, MW-7B, MW-8A, and MW-8B. Text indicates that ponded water and inundation of land surface were observed in wetlands, however, field wetland characterization tables in Appendix F of the same report note that soil was saturated to the surface but not ponded water Peat deposits underlie portions of the landfill
(G&M, 1996a) "Remedial Investigation Addendum I, 12 th Street Landfill Operable Unit, Plainwell, Michigan, Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site," March 26, 1996.	<p>Describe the results of an additional groundwater sampling event in August 1995.</p> <ul style="list-style-type: none"> Monitor the elevation of water in and around the landfill and in the Kalamazoo River, and assess the direction of groundwater flow. Define the distribution of PCBs in groundwater. 	<ul style="list-style-type: none"> River stage and groundwater elevations monitored Groundwater and leachate samples analyzed for PCBs 	<ul style="list-style-type: none"> Surface water in the river flows from the upstream side of the dam into the groundwater system of the surficial aquifer, and then flows beneath the landfill, and then back into the river on the downstream side of the dam PCBs were not detected in unfiltered samples of groundwater Aroclor-1242 was detected in one of three unfiltered leachate samples at a concentration of 0.0014 mg/L. 	

Summary of Previous Investigations (continued)

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(G&M, 1996b). "Remedial Investigation Report, 12 th Street Landfill Operable Unit, Plainwell Michigan, Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site " Geraghty and Miller, Inc. December 20, 1996.	<ul style="list-style-type: none"> Summarize previous investigations. Present sampling methods and results of residual samples collected from the Kalamazoo River. Discuss the nature and extent of contamination at the landfill. Evaluate the fate and transport processes for the identified chemicals of potential concern 	Two grab samples of residuals were collected from the Kalamazoo River bed from locations adjacent to the landfill analyzed for PCBs	<ul style="list-style-type: none"> Slug test data indicate a hydraulic conductivity of 1.2×10^{-1} cm/s to 5.3×10^{-3} cm/s in the surficial aquifer. Total PCB concentrations for the two samples of residuals collected from the riverbed 5 feet east of the landfill berm were 17 mg/kg and 29 mg/kg Soil samples collected from beneath the landfill tended to contain PCBs at concentrations one to two orders of magnitude lower than the residuals immediately above them. Concentrations of PCBs in the subsurface soil ranged from below the detection limits to 52 mg/kg, with a mean of 4.9 mg/kg PCBs are strongly bound to the paper residuals, migration of PCBs via groundwater is low. Surface water transport and erosion of exposed residuals on the landfill berm is the most likely future migration pathway for PCB contamination from the landfill 	Very little new data. Summarizes existing data
(U.S. EPA, 2004). Former Discharge Channel Investigation.	<ul style="list-style-type: none"> Delineate the extent of PCB-containing residuals to be excavated from the former powerhouse discharge channel adjacent to the landfill Identify materials within reach of excavation equipment. 	<ul style="list-style-type: none"> Sampling grid of 20 feet perpendicular to channel and 50 feet parallel to channel, extending 60 feet into channel from west bank, and 250-300 feet along the east side of landfill Samples collected from a maximum depth of 1 foot Sample cores visibly contaminated with paper residuals not analyzed, it was assumed that those residuals would exceed cleanup criteria Twenty-eight samples analyzed for PCBs only 	<ul style="list-style-type: none"> Total PCB concentrations ranged from nondetect to 34 mg/kg. Highest concentration of 34 ppm was located at a depth interval of 0.5-0.7 feet, approximately 60 feet from bank near northeastern corner of landfill 	Results poorly documented. Results are summarized in Appendix 3 of U.S. EPA, 2004. Documentation of results is incomplete
(BBL, 2001) "Geotechnical Sample Analytical Data, 12 th Street Landfill Operable Unit." Transmittal Letter with Attachments. Blasland, Bouck & Lee, Inc. June 25, 2001	<ul style="list-style-type: none"> Evaluate material properties in the berms and paper residuals. 	<p>Ten soil borings (3 within retaining berms, 5 within residuals, 2 at edge of residuals) tested for:</p> <ul style="list-style-type: none"> Moisture content (21) Specific gravity (11) Organic content (6) Bulk density (6) Grain size (12) Atterberg limits (6) Consolidation (4) UU Triaxial (4) Vane shear (8) 	<p>[Conclusions by RMT. Report contains only data]</p> <ul style="list-style-type: none"> Residuals typically have soft consistency. Berm materials (sand, fly ash and residuals) typically have loose density. Vane shear test results indicate that residuals have sensitivity ranging from 3 to 6 (strength loss from undisturbed to remolded condition). 	



LEGEND

- TOP SOIL, BROWN TO TAN SANDY ORGANIC-RICH TOPSOIL
- CLAY ASH
- CONSTRUCTION DEBRIS, HEAVY SAND, CONCRETE, BRICK, BALT WIRE, CORRUGATED METAL, AND MISCELLANEOUS WASTE
- RESIDUALS, GRAY TO BLACK SANDY TO CLAYEY PAPER
- DUE TO MEDIUM SAND, TAN TO WHITE TO BROWN FINE TO MEDIUM SAND, TRACE COARSE SAND, SAND UNIT
- WHEAT TO COARSE SAND, MALT-COLORED MEDIUM TO COARSE SAND, COARSE SAND, SAND, SAND AND GRAVEL UNIT
- FLAT DARK BROWN TO BLACK PEAT
- GEOLOGIC CONTOUR (QUESTION MARKS WHERE INTERFERED)
- LOCATION OF SOIL SAMPLE SUBMITTED FROM BORING FOR ANALYSIS OF CONSTITUENTS ON TC AND TL
- LOCATION OF SOIL SAMPLE SUBMITTED FROM BORING FOR ANALYSIS OF PCBs
- MONITORING WELL WITH SCREENED INTERVAL
- BASE OF BORING
- W-1-A JONHONSON WELL DESCRIPTION
- QASB-7/AH-1 SOIL BORING/ALLOPATE HEAD WELL DESCRIPTION
- TP-7 TEST PIT OR TRENCH DESCRIPTION
- QASB-3 SOIL BORING DESCRIPTION

NOTES:
1. THE GEOPHYSICAL PROFILE AND THE BOREHOLE A BOREHOLE WORK PLAN
2. THE DOWN AND INCREASE OF SUBSURFACE UNITS ON THE CROSS-SECTION
3. THE LOCATION OF THE ACTUAL SURFACE CONDITIONS EXIST ONLY AT
THE INDICATED LOCATIONS



DRILLING CONTRACTOR: THE DRILLING AND BOREHOLE SERVICES, INC. 1000 N. W. 10TH AVE. SUITE 100 FORT LAUDERDALE, FL 33304-4400
PHONE: (305) 466-1111 FAX: (305) 466-1112
E-MAIL: GBRAGHTY@GMS-FLA.COM
ALL BOREHOLES AND TEST PITS WERE CONDUCTED BY GBRAGHTY & MILLER, INC.

DATE	DESCRIPTION	BY	DATE
10/1/01	DRILLING CONTRACTOR: THE DRILLING AND BOREHOLE SERVICES, INC. 1000 N. W. 10TH AVE. SUITE 100 FORT LAUDERDALE, FL 33304-4400 PHONE: (305) 466-1111 FAX: (305) 466-1112 E-MAIL: GBRAGHTY@GMS-FLA.COM ALL BOREHOLES AND TEST PITS WERE CONDUCTED BY GBRAGHTY & MILLER, INC.		

GEOLOGIC CROSS-SECTIONS OF LANDFILL
REMEDIAL INVESTIGATION TECHNICAL REPORT NUMBER 8
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

KB60105732